

REMARKS

Applicants respectfully acknowledge receipt of the Office Action mailed June 22, 2006.

In the Office Action, the Examiner rejected claims 1-4 and 14 under 35 U.S.C. § 102(e) as being anticipated by *Li et al.* (U.S. Patent No. 6,284,149); rejected claim 5 under 35 U.S.C. § 103(a) as being unpatentable over *Li*; and rejected claim 14 under 35 U.S.C. § 103(a) as being unpatentable over *Li* in view of *Jiang et al.* (U.S. Patent No. 6,455,411).

By this Amendment, Applicants amend claims 1-5 and 14. Upon entry of this Amendment, claims 1-5 and 14 will remain pending. Of these claims, claims 1 and 14 are independent. Claims 6-12 and 15-17 were previously canceled in the "Amendment After Final" filed September 4, 2003, and claim 13 was previously canceled in the "Reply to Office Action" filed June 21, 2004.

The originally-filed specification, claims, abstract, and drawings fully support the amendments to claims 1-5 and 14. No new matter has been introduced.

Applicants traverse the rejections above and respectfully request reconsideration for at least the reasons that follow.

I. 35 U.S.C. § 102(e) REJECTION

Claims 1-4 and 14 stand rejected under 35 U.S.C. § 102(e) as being anticipated by *Li*. Applicants respectfully disagree with the Examiner's arguments and conclusions and submit that independent claims 1 and 14 patentably distinguish over *Li* at least for the reasons set forth below.

In order to properly establish that *Li* anticipates Applicants' claimed invention under 35 U.S.C. § 102, each and every element of each of the claims in issue must be disclosed, either expressly described or under principles of inherency, in that single reference. Furthermore, "[t]he identical invention must be shown in as complete detail as is contained in the ... claim." See M.P.E.P. § 2131, quoting *Richardson v. Suzuki Motor Co.*, 868 F.2d 1126, 1236, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989).

Li discloses a plasma etching process for etching a carbon-based low-k dielectric layer in a multi-layer inter-level dielectric. The low-k dielectric may be BCB, which contains about 4% silicon, the remainder being carbon, hydrogen, and a little oxygen. The BCB etch uses an etching gas of oxygen, a fluoro carbon, and nitrogen, but no argon (emphasis added). (*Li*, Abstract). The multi-layer inter-level dielectric includes a substrate 10, a lower stop layer 14, a low-k lower dielectric layer 16, an upper stop layer 18, a low-k upper dielectric layer 20, and a hard mask layer 42. (*Id.* at col. 6, line 56 - col. 7, line 31).

Li, however, fails to disclose the BCB etch using a processing gas having a selection ratio greater than approximately 2.0, wherein the selection ratio is defined by an etching rate of an organic etching target film divided by an etching rate of a resist layer. Additionally, as admitted by the Examiner, "*Li* does not teach etching BCB with a mixture of CF₄ and N₂." (*Office Action*, p. 4, line 6). Accordingly, *Li* necessarily fails to teach or suggest wherein the etching gas has a flow rate ratio of CF₄ and N₂ within a range of $1 \leq (\text{N}_2 \text{ flow rate} / \text{CF}_4 \text{ flow rate}) \leq 4$.

Accordingly, with respect to independent claim 1, *Li* fails to teach or suggest the claimed combination, including, *inter alia*:

“wherein [a] processing gas has a selection ratio greater than approximately 2.0, the selection ratio defined by an etching rate of [an] organic etching target film divided by an etching rate of [a] resist layer” (emphasis added).

Similarly, with respect to independent claim 14, it is also clear that *Li* does not teach or suggest each and every element, including, *inter alia*:

“wherein a flow rate ratio of CF_4 and N_2 in [a] processing gas is set within a range of $1 \leq (\text{N}_2 \text{ flow rate} / \text{CF}_4 \text{ flow rate}) \leq 4$ ” (emphases added).

The Examiner has therefore not met the essential criteria for showing anticipation, wherein “each and every element of each of the claims in issue must be found, either expressly described or under principles of inherency, in...a...single reference.” See M.P.E.P. § 2131. Accordingly, independent claims 1 and 14 are patentable over *Li*. Applicants therefore request that the rejection of claims 1 and 14 under 35 U.S.C. § 102(e) be withdrawn and claims 1 and 14 be allowed.

Moreover, claims 2-4 are in condition for allowance at least due to their dependence from independent claim 1. In addition, at least some of the dependent claims may recite unique combinations that are neither disclosed nor suggested by the cited art, and therefore some also are separately patentable.

II. 35 U.S.C. § 103(a) REJECTIONS

Claim 5 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over *Li*. As explained above, with respect to independent claim 1, *Li* fails to disclose or suggest, *inter alia*, “wherein [a] processing gas has a selection ratio greater than approximately

2.0, the selection ratio defined by an etching rate of [an] organic etching target film divided by an etching rate of [a] resist layer," as required by claim 1 (emphasis added). Claim 5 is therefore patentable over *Li* at least due to its dependence from claim 1. Applicants therefore request that the rejection of claim 5 under 35 U.S.C. § 103(a) be withdrawn and claim 5 be allowed.

Claim 14 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over *Li* in view of *Jiang*. Applicants respectfully disagree with the Examiner's arguments and conclusions and submit that independent claim 14 patentably distinguishes over *Li* and *Jiang* at least for the reasons described below.

In order to establish a *prima facie* case of obviousness under 35 U.S.C. §103(a), each of three requirements must be met. First, the reference or references, taken alone or combined, must teach or suggest each and every element recited in the claims. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the references in a manner resulting in the claimed invention. Third, a reasonable expectation of success must exist. Moreover, each of the three requirements must "be found in the prior art, and not be based on applicant's disclosure." See M.P.E.P. §2143, 8th ed., February 2003.

Li discloses a plasma etching process for etching a carbon-based low-k dielectric layer in a multi-layer inter-level dielectric. The low-k dielectric may be BCB, which contains about 4% silicon, the remainder being carbon, hydrogen, and a little oxygen. The BCB etch uses an etching gas of oxygen, a fluoro carbon, and nitrogen, but no argon

(emphasis added). (*Li*, Abstract). The multi-layer inter-level dielectric includes a substrate 10, a lower stop layer 14, a low-k lower dielectric layer 16, an upper stop layer 18, a low-k upper dielectric layer 20, and a hard mask layer 42. (*Id.* at col. 6, line 56 - col. 7, line 31).

However, as admitted by the Examiner, "*Li* does not teach etching BCB with a mixture of CF₄ and N₂." (*Office Action*, p. 4, line 6). Additionally, *Li* fails to teach or suggest a processing gas having a flow rate ratio of CF₄ and N₂ within a range of $1 \leq (\text{N}_2 \text{ flow rate} / \text{CF}_4 \text{ flow rate}) \leq 4$, as required by Applicants' claim 14 (emphases added).

Thus, in order to cure the deficiencies of *Li*, the Examiner relies on *Jiang* for its alleged use of "CF₄ and C₄F₈[,] or a mixture of the two...[,] combined with N₂[,] to etch an organic silicate." (*Office Action*, p. 4, lines 7-8).

Jiang discloses a dual damascene process for low-k or ultra low-k dielectrics, such as organo-silicate glass (OSG), wherein a trench 121 is etched in the OSG layer 108 using a less-polymerizing fluorocarbon added to an etch chemistry comprising a fluorocarbon and low N₂/Ar ratio (emphasis added). (*Jiang*, Abstract)

Jiang, however, fails to explicitly teach or suggest wherein a flow rate ratio of CF₄ and N₂ in a processing gas is set within a range of $1 \leq (\text{N}_2 \text{ flow rate} / \text{CF}_4 \text{ flow rate}) \leq 4$ (emphases added).

Accordingly, with respect to independent claim 14, *Li* and *Jiang* fail to teach or suggest the claimed combination, including, *inter alia*:

"wherein a flow rate ratio of CF₄ and N₂ in [a] processing gas is set within a range of $1 \leq (\text{N}_2 \text{ flow rate} / \text{CF}_4 \text{ flow rate}) \leq 4$ " (emphases added).

The Examiner has therefore not met at least one of the essential criteria for establishing a *prima facie* case of obviousness, wherein “the prior art reference (or references when combined) must teach or suggest all the claim limitations.” See M.P.E.P. §§ 2142, 2143, and 2143.03. Accordingly, independent claim 14 is patentable over *Li* and *Jiang*. Applicants therefore request that the rejection of claim 14 under 35 U.S.C. § 103(a) be withdrawn.

III. CONCLUSION

Applicants respectfully submit that independent claims 1 and 14 are in condition for allowance. In addition, claims 2-5 are in condition for allowance at least due to their dependence from independent claim 1.

The Office Action contains characterizations of the claims and the related art with which Applicants do not necessarily agree. Unless expressly noted otherwise, Applicants decline to subscribe to any statement or characterization in the Office Action.

In view of the foregoing amendments and remarks, Applicants respectfully request reconsideration and reexamination of this application and the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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